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Effects of U.S. Dairy Policies on Markets for Milk and Dairy Products

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Abstract

This report examines the economic effects of the principal programs authorized under the Farm Security and Rural Investment Act of 2002 that influence the U.S. dairy sector. The analytical results presented in this study were used as input to a broader study mandated by Congress, which required an evaluation of the economic impacts of Federal milk marketing orders, direct payments to producers, price supports, and export programs. This study examines the effects of dairy policies on prices, program payments, and other variables under different scenarios. The results are compared to a baseline set of estimates over the 2002-07 period. The findings show that gross income in the U.S. dairy sector would be $7.2 billion below baseline levels over the course of this period if the programs were discontinued. Over the same period, cumulative Government outlays for these programs would be approximately $5.5 billion below baseline levels.

Keywords: Farm Security and Rural Investment Act of 2002, Milk Price Support Program, Dairy Export Incentive Program (DEIP), Federal Milk Marketing Order (FMMO) system, Milk Income Loss Contract (MILC) Program, Food and Agricultural Policy Simulator (FAPSIM).

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Introduction

Government programs have been an integral part of the U.S. dairy sector for nearly 70 years. To understand how these programs influence the sector, it is necessary to examine how the sector might react if these programs were eliminated. This study provides a basis for understanding the effects of these policies. It presents estimates of the impacts of eliminating the principal programs affecting the dairy sector by examining their effect on prices, production, use, farm income, and budgetary costs.

The study also serves a second purpose. The Farm Security and Rural Investment Act of 2002 (2002 Act) required the Secretary of Agriculture to prepare a study that evaluates national dairy policy. As part of this mandate, the Congress required an evaluation of the economic impacts of Federal milk marketing orders, direct payments to producers, price supports, and export programs. The results in this study were used in this broader study mandated by Congress (USDA, forthcoming).

Many of the existing Federal dairy programs date back to the 1930s and 1940s. Although their basic structure has remained the same through the present, these programs have been continually modified over time in response to changing market conditions. Since the 1940s, additional programs have been either introduced or discontinued in reaction to new concerns that emerged as the dairy industry evolved.[1]

Prior to the 2002 Act, the major national programs affecting dairy were the Milk Price Support Program, the Dairy Export Incentive Program, the Federal Milk Marketing Order system, and the Dairy Market Loss Assistance Program. The 2002 Act did not make any substantive changes to the first three of these programs. However, it replaced the Dairy Market Loss Assistance Program with the Milk Income Loss Contract Program.

Milk Price Support Program (MPSP)

Under the MPSP, the Commodity Credit Corporation (CCC) stands ready to purchase all the cheese, butter, and nonfat dry milk that are offered for sale at specified prices. The program therefore indirectly provides a price floor on all milk that is marketed domestically by supporting the price of these manufactured dairy products.

The 2002 Act set the support price for milk at $9.90 per hundredweight over the life of the legislation (2002-07). The support prices for individual dairy products are based on the support price of milk and on the costs of converting raw milk into cheese, butter, and nonfat dry milk. The price formulas are designed to enable manufacturers of average efficiency to pay producers a price that is no lower than the support price for milk.

Dairy Export Incentive Program (DEIP)

DEIP enhances the total demand for U.S. dairy products. The program subsidizes the export of selected dairy products (primarily cheese, butter, and nonfat dry

milk) in targeted foreign markets. Under this program, USDA pays cash bonuses to private U.S. exporters of dairy products purchased from domestic commercial sources. This allows the exporters to sell these products at prices that are potentially below their acquisition costs. Both the total quantities exported and the total budgetary expenditures under this program are subject to limits imposed by commitments with the World Trade Organization (USDA, 2003a).

Milk Income Loss Contract (MILC) Program

The MILC Program provides dairy producers with a degree of income protection from price volatility. The payment rate for the program is established on a monthly basis. It is 45 percent of the difference between $16.94 and the Boston Class I price per hundredweight established by the Federal Milk Marketing Order system (if this difference is positive). All producers receive the same payment rate for a given month, and payments must be made within 60 days of the last day of the month in which payments are triggered (USDA, 2002b).

Producers need only enroll in the program to qualify for payments. However, the MILC Program established a cap on the production for each farm operation that is eligible for program benefits. MILC participants may receive payments on at most 2.4 million pounds of the total milk marketed in a given fiscal year.

Under the provisions of the 2002 Act, the MILC Program is authorized through September 30, 2005. Thus, the program is relatively short-term.

Federal Milk Marketing Order (FMMO) System

The FMMO system regulates milk markets by setting regional minimum prices of milk for four different classes of use, and pooling revenues so that producers are paid a minimum weighted average or uniform blend price (Manchester and Blayney, 2001). Competitive market prices of dairy products—butter, nonfat dry milk, cheese, and whey—are used to establish monthly minimum prices for milk used in butter and nonfat dry milk (Class IV) and for milk used in cheese (Class III). Minimum prices for milk in fluid

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[1] Manchester (1983), USDA (1984), Fallert, Blayney, and Miller (1990), and Blayney, Miller, and Stillman (1995) describe the history of U.S. dairy policy.

use (Class I) are determined monthly by adding a fixed differential to the higher of an advanced calculation of the Class III and Class IV prices. The differentials range between $1.60 and $4.30, averaging about $2.69 per hundredweight. For milk used in soft manufactured products (Class II), a differential of $0.70 per hundredweight is added to the Class IV price. Thus, to the extent that the minimum order price is binding for a particular class of milk, producers receive a premium on that milk over the market price that would be in effect in the absence of the FMMO system.

However, in many markets, prices are generally driven above Federal order minimums by market forces.

All similarly located producers within a Federal order region receive the same uniform blend price for their milk. The blend price is a weighted average of the individual class prices, where the weights are determined by the proportion of milk utilized in each class by milk processors regulated under the order. As a result, the program may reduce price differences among producers within a Federal order region.

Scenario Descriptions and Assumptions

Some dairy programs were designed to operate in concert with each other. Nevertheless, it is useful to analyze the incremental effects of each of these programs on the dairy sector.

The approach used in this analysis is to remove the programs sequentially. The order in which the programs were removed reflects how interconnected they are. For example, the payment rate associated with the MILC Program is based on the formula that is used to establish the FMMO price for Class I milk in Boston. Therefore, the FMMO system cannot be eliminated while maintaining the MILC Program. Such considerations dictate the order in which these programs are eliminated.

The scenarios are defined as follows:

(1) Elimination of the MPSP;

(2) Elimination of the MPSP, and DEIP;

(3) Elimination of the MPSP, DEIP, and MILC;

(4) Elimination of the MPSP, DEIP, MILC, and FMMO system.

The analysis examines the 2002-07 period (the duration of 2002 Act). All of the impacts were estimated using the Food and Agricultural Policy Simulator (FAPSIM).[2] Within the context of this modeling framework, the programs were eliminated sequentially based on the following set of assumptions.

Scenario 1

The MPSP was terminated in this analysis by setting all CCC purchases under this program to zero over the 2002-07 period for cheese, butter, and nonfat dry milk. This assumption essentially removes any price-enhancing aspects associated with the MPSP. As such, CCC purchase prices no longer act as a price floor for any of these commodities.

Furthermore, CCC beginning stock levels for these commodities were frozen at their 2002 levels over the entire 2002-07 period. This assumption was used to isolate existing CCC stocks from the market. If the

CCC reduced its stocks over the period by disposing of them in commercial markets, the effect would be to depress dairy prices. The assumption used in this analysis neutralizes the effects of current stocks on the market.

Scenario 2

DEIP was terminated by setting all exports under this program to zero. The analysis assumes that the DEIP does not displace any commercial exports of dairy products. In other words, each unit of product exported under this program increases total dairy exports by the same amount.

Scenario 3

The MILC Program was terminated in this analysis by setting the program target price of $16.94 per hundredweight to zero over the 2002-05 period. This effectively removes all income-enhancing aspects of the program.

Scenario 4

FAPSIM approximates the operation of the FMMO system by incorporating the formulas that are used to set the minimum order price for each class of milk (USDA, 2002a). The Class I price equals the Class I differential plus the higher of the Class III or Class IV price. The average Class I differential that has been in effect since 2000 is $2.69 per hundredweight. This analysis assumes that $1.30 of this price differential is due to transportation costs and other factors. In other words, this portion of the Class I differential would exist even in the absence of the FMMO system. To model the effects of eliminating the program, the Class I differential was therefore set at $1.30 per hundredweight to obtain estimates of the impact of this program.[3]

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[2] Appendix B contains a brief summary of the model.

[3] Because the FMMO system has been an integral part of the pricing system for milk since the 1930s, it is difficult to determine how the sector would react if the program were to be abolished. The assumption that the Class I differential would be $1.30 per hundredwieght in the absence of the FMMO system was based primarily on the analysis by Pratt, Bishop, Erba, Novakovic, and Stephenson (1998).

Model Results

All of the scenarios are examined by comparing their impacts against a set of baseline estimates over the 2002-07 period. The results are conditioned by the baseline chosen for this analysis. For example, if the underlying baseline exhibited high prices throughout the period of analysis, most of the scenarios would show little or no impacts associated with eliminating the programs.

The set of baseline projections used for this analysis closely approximates the official USDA baseline (USDA, 2003b). This particular baseline generally exhibits lower prices in the initial years and higher prices in the final years of the analysis. This means that we should expect the impacts associated with all of the scenarios to be larger in the initial years.

For each scenario, the analysis traces the movements in prices, utilization, and production for all of the major dairy products. The analysis also includes some aggregate indicators, such as cash receipts from farm marketings of dairy products and Federal outlays on dairy programs.

Scenario 1

Given the baseline used for this analysis, the elimination of the MPSP primarily affects the market for nonfat dry milk. Although price supports are in effect for cheese and butter, the baseline market prices for these products are high in relation to their respective support prices. As a consequence, there are little or no CCC purchases of these dairy products in the baseline. Thus, the elimination of the program does not directly affect the product markets for cheese or butter.

The situation for nonfat dry milk is different. Given the baseline prices, the CCC is expected to purchase nonfat dry milk over the entire 2002-07 period. In the baseline, CCC purchases average approximately 17 percent of total production of nonfat dry milk. The elimination of the MPSP reduces the effective demand for this product by reducing CCC purchases to zero. As a consequence, the wholesale price of nonfat dry milk declines by 15 to 20 percent below the baseline in the first 2 years of the analysis. Over the 2002-07 period, the price is approximately 10 percent below baseline levels (table 1, see p. 12).[4]

The decline in nonfat dry milk price leads to a decline in the profitability of using milk to manufacture nonfat dry milk and butter relative to other uses for milk. As a result, milk production is diverted to alternative uses under this scenario (tables 7, 8, and 9).[5]

Increased market supplies generally lead to lower prices for alternative uses for milk. The wholesale cheese price and the Class I price for milk both decline by approximately 2 percent below the baseline, on average, over the period (tables 3 and 4).[6]

Butter is an exception. Butter is produced as a coproduct with nonfat dry milk. Because nonfat dry milk prices decline, less milk is used to produce both nonfat dry milk and butter. Butter prices consequently increase by 14 percent above baseline levels over 2002-07 (table 2).

The price declines for nonfat dry milk and cheese lead to a decline in the price of milk used for manufacturing purposes (table 5). This, in turn, leads to a overall decline in the price received by farmers for all milk (table 6). In the initial years of the analysis (2002-03), the farm price of milk is 5 to 7 percent below baseline levels.

Producers respond to the lower prices by reducing production (table 10), which mitigates the impacts associated with eliminating the MPSP in the latter years of the analysis. By the final years of the analysis, the farm price is less than 1 percent below baseline levels.

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[4] The baseline used for this analysis assumes that the support price for nonfat dry milk is $1.01 per pound over the 2002-07 period. The support price for nonfat dry milk has subsequently been adjusted downward to $0.80 per pound. Thus, the results probably overstate the price effects that elimination of MPSP would have on the sector.

[5] In particular, milk would be diverted to fluid use or to the production of cheese.

[6] The Class I price increases above baseline levels in 2004. This is due to the specification used in FAPSIM to estimate the demand for fluid milk. The equation contains a long-run response coefficient. As a result, consumers responding to the relatively large price adjustments in the first 2 years of the analysis do not adjust instantaneously as market conditions change. Thus, due to the lagged response, fluid use demand increases above baseline levels in 2004, even though the Class I price is above baseline levels.

Cash receipts decline for the dairy sector due to both lower prices and lower production. Cumulative cash receipts from farm marketings are approximately $3.5 billion below the baseline over the 2002-07 period (table 11). However, part of this decline in market receipts is offset by an increase in payments under the MILC Program. Due to the lower prices, cumulative payments associated with the MILC Program are $0.6 billion above baseline levels (table 12).

Despite increased MILC Program payments, there are savings in Federal outlays associated with eliminating the MPSP (table 13). Cumulative CCC expenditures are approximately $1.0 billion below baseline levels over the 2002-07 period. Furthermore, expenditures declined in all years except one, fiscal year 2003.

All of these results should be interpreted as representing upper bounds on the impacts to the dairy sector of eliminating the MPSP. The modeling framework used for this analysis treats the commercial export demand for dairy products exogenously. This means that commercial exports of the products do not change as product prices change in FAPSIM. This is an especially important consideration for nonfat dry milk. Because nonfat dry milk prices decline by 10 percent on average over 2002-07, commercial exports of nonfat dry milk could potentially increase under the scenario. If this occurred, the price impacts associated with nonfat dry milk would be smaller. This would reduce the magnitude of the impacts associated with other dairy products as well.

Scenario 2

Historically, DEIP has been used to reduce the CCC expenditures associated with supporting the price of milk. If the CCC purchases a particular commodity, the CCC is more inclined to authorize DEIP subsidies for that commodity. By increasing the quantity that is sold on foreign markets, the CCC is less likely to incur costs in acquiring the commodity to support its price domestically.

The baseline used for this analysis reflects this interrelationship between the MPSP and DEIP. The baseline assumes that all DEIP payments are made for nonfat dry milk so as to reduce the budgetary costs of the MPSP. This means that, directionally, the impacts associated with eliminating both the MPSP and DEIP are identical to those already discussed in Scenario 1. Eliminating DEIP essentially implies a further reduction in the aggregate demand for nonfat dry milk.

Thus, the main distinction between the two scenarios is that the impacts are larger (in absolute terms) for Scenario 2.

Exports under DEIP account for approximately 9 percent of the total production of nonfat dry milk, on average, in the baseline. Due to the reduction in the demand for nonfat dry milk caused by the elimination of DEIP, the wholesale price declines by approximately 15 percent below the baseline levels in this case, versus 10 percent in Scenario 1 (table 1). A similar pattern exists among relative size of the impacts associated with the remaining prices. FAPSIM estimates that all the price impacts in Scenario 1, measured as a percentage change from the baseline, are approximately 50 percent larger in Scenario 2 (tables 2-6).

Cumulative cash receipts from farm marketings decline approximately $5.3 billion below the baseline over 2002-07 for Scenario 2 due to the larger price and quantity adjustments (table 11). Under Scenario 2, cumulative MILC payments increase by approximately $0.9 billion above baseline levels over 2002-07 (table 12).

There is virtually no difference in the Federal budgetary savings between Scenarios 1 and 2. All of the additional savings associated with eliminating DEIP in Scenario 2 are offset by additional costs associated with the MILC Program.

Scenario 3

The MILC Program has the largest influence on the baseline estimates during the initial years of the analysis for three reasons. First, the program is due to terminate on October 1, 2005. Thus, the program is irrelevant over the final 2 years of the analysis. Second, because prices strengthen over time in the baseline, the MILC Program becomes progressively less important as an income-enhancing mechanism for the sector. Finally, the proportion of milk marketings that are eligible for program payments diminishes as the industry shifts to larger and more efficient operations. Thus, over time, more production becomes subject to the 2.4-million-pound limitation on the quantity of milk that is eligible for payments on each dairy operation.[7]

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[7] In FAPSIM, 52.0 percent of total milk production is estimated to be eligible for payments in 2002. This estimate declines steadily over time to 44.5 percent in 2005. Price, Stillman, and Seeley (2003) provide a detailed description of the procedure used to obtain these estimates.

Despite the cap on the marketings that are eligible for MILC payments, the program influences production decisions by providing income support payments on a portion of total production. Thus, the program acts to mute the production response to lower market prices.

Eliminating MPSP, DEIP, and MILC simultaneously therefore reduces milk production below the levels in Scenario 2 (table 10). Lower milk production causes prices for all of the dairy products to be higher in Scenario 3 than in Scenario 2 (tables 1-6).

With the exception of butter, all the prices tend to be below baseline levels under Scenario 3. On average, the all-milk price declines 1.5 percent below baseline levels over 2002-07. This is less than the percentage decline under either Scenarios 1 or 2 (table 6).

The change in cash receipts from farm marketings is similar to Scenario 1. Cumulative cash receipts fall by $3.8 billion below baseline levels over 2002-07 (table 11). This reflects the lower production and marketings under Scenario 3 relative to Scenario 2.

Unlike the previous scenarios, farmers do not receive government payments under the MILC Program to compensate them for market losses. The budgetary savings under Scenario 3 total more than $5.5 billion over 2002-07 (table 13).

Scenario 4

By assumption, eliminating the FMMO system reduces the Class 1 price differential, thereby reducing the price that consumers pay for fluid milk (table 4). Fluid prices decline almost 8 percent below baseline levels, on average, over 2002-07. This compares with a 1.6-percent decline under Scenario 3.

Consumers respond to this price change by increasing their demand for fluid milk by approximately 2 percent above the baseline over the 2002-07 period (table 9). Lower milk production coupled with increased fluid milk use reduces the supply of milk available for manufactured dairy products, leading to higher manufactured milk prices (table 5). Thus, despite the reduction in the demand for nonfat dry milk due to the elimination of the MPSP and DEIP, the overall manufactured milk price increases by over 2 percent above the baseline, on average, over the 2002-07 period (table 5).

The overall price of milk is a weighted average of the prices of milk sold for fluid use and for manufacturing purposes. Because these two prices move in opposite directions, the change in the all-milk price is very similar to that under Scenario 3 (table 6). As a result, the cumulative changes in cash receipts and in CCC outlays are virtually identical for Scenarios 3 and 4.

Summary

All the scenarios share some common characteristics. The impacts of eliminating the dairy programs are larger during the initial years of the analysis. This stems primarily from the fact that the baseline exhibits lower prices in the early years. Thus, the programs have a larger influence on the sector during the initial years of the analysis (figs. 1, 3).

The production response is also an important factor influencing this result. Once producers are given time to adjust herd sizes in response to the initial price changes, the impacts in the latter years of the analysis become muted due to lower milk supplies.

Figures 1 through 3 summarize the impacts for some of the key indicators for the sector. For the reasons already cited, the largest impacts on most variables occur in the initial 2 years of the analysis for all scenarios. In absolute terms, the percentage change in farm price is almost 10 times as large as the percentage change in production in 2002 for each of the scenarios (figs. 1, 2). This is due to the inability of producers to adjust production significantly in the short run.

Gross income depicted in figure 3 is the sum of cash receipts from farm marketings and from government payments associated with the MILC Program. Because production declines under each of the scenarios, total production expenses also decline. Thus, the decrease in **net** farm income experienced by dairy producers would be less than the decrease in gross farm income indicated by the figure.

The national farm income accounts do not break out production expenses by type of farm operation. Without this detailed information, it is impossible to determine how the elimination of the programs would affect net farm income for dairy producers directly. However, figure 4 indicates how farm income for the entire agricultural sector changes when the programs are eliminated. Because these income changes primarily reflect adjustments in the dairy sector, they can be used as a crude approximation of the adjustments in net farm income for dairy producers.[8] Over 2002-07, the cumulative effects on net farm income for the agricultural sector are roughly half as large as effects on gross income for dairy producers (tables 14-15).

The largest aggregate sector impacts are associated with Scenarios 3 and 4. Producers bear the largest declines in gross income because both cash receipts from farm marketings and government income support payments decline under each of these scenarios.

Of the four scenarios, the least confidence should be placed in the results associated with Scenario 4. Although the FMMO system is an integral part of the FAPSIM dairy model, the specification may not adequately capture the full importance of the order system on the sector.

A further concern is the assumption used to implement the scenario. The FMMO system has underpinned the pricing mechanism for milk since its inception over 60 years ago. If the program is terminated, it is difficult to predict how the markets would adjust to this new environment. The assumption that the Class I differential would be $1.30 per hundredweight in the absence of the program is therefore debatable.

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[8] The adjustments in the dairy sector affect the net farm income associated with a large number of commodities. For example, lower milk production leads to lower feed demand. As a result, grain prices are lower under each of the scenarios. This, in turn, leads to lower crop production. Thus, cash receipts for feed grains also decline below baseline levels for each of the scenarios. Production expenses for these crops decline as well.

Figure 1
Producer price of all milk: Percentage change from the baseline
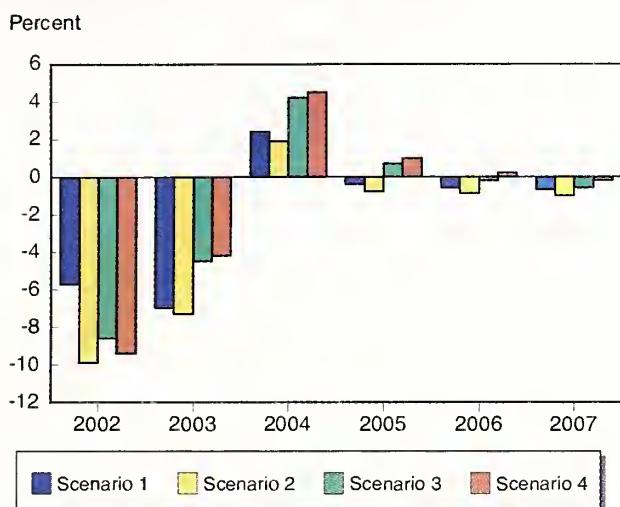
Percent

Figure 2
Milk production: Percentage change from the baseline

Percent
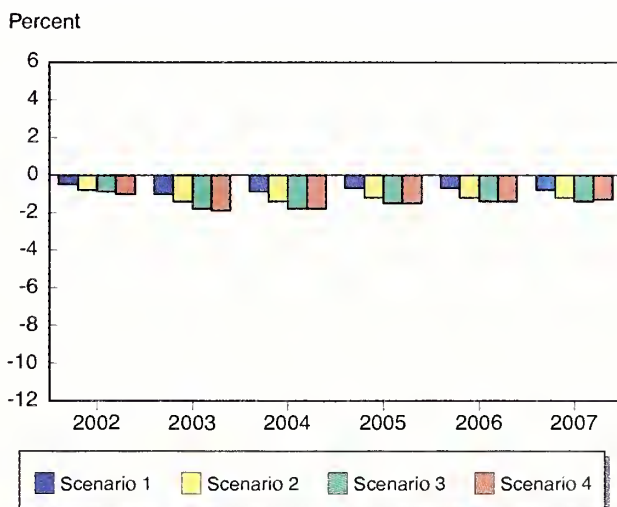

Figure 3
Gross income for dairy: Change from the baseline
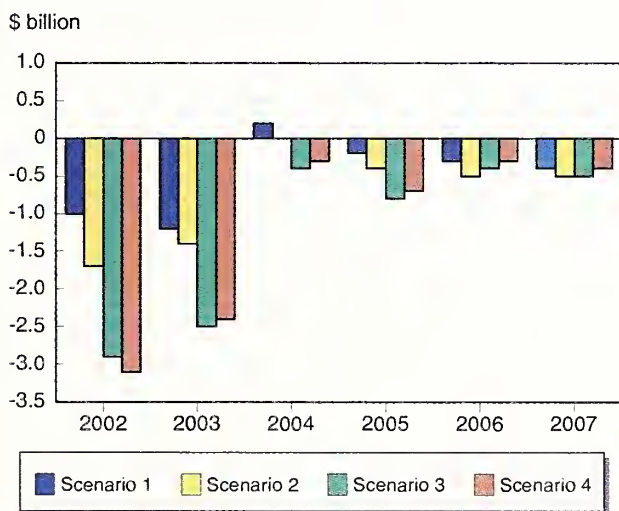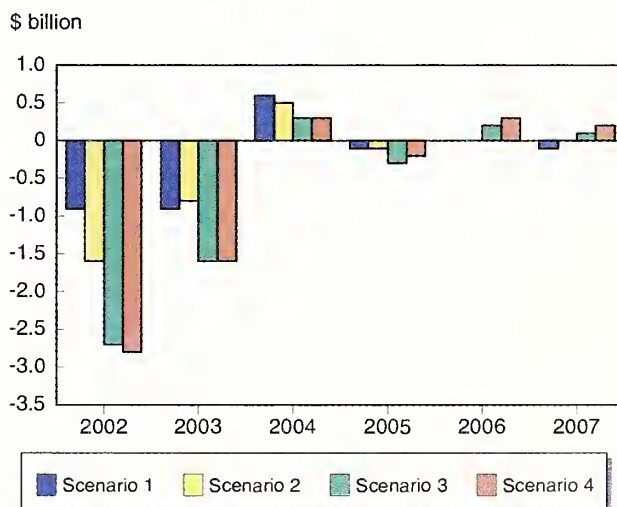
$ billion

Figure 4
Net farm income for the agricultural sector: Change from baseline

$ billion

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

References

Blayney, Don P., James J. Miller, and Richard P. Stillman. *Dairy: Background for the 1995 Farm Legislation*. U.S. Department of Agriculture, Economic Research Service, AER-705, 1995.

Fallert, Richard F., Don P. Blayney, and James J. Miller. *Dairy: Background for the 1990 Farm Legislation*. U.S. Department of Agriculture, Economic Research Service, Staff Report AGES 9020, 1990.

Gadson, Kenneth E., J. Michael Price, and Larry E. Salathe. *The Food and Agricultural Policy Simulator (FAPSIM)*. U.S. Department of Agriculture, Economic Research Service, ERS/NED Staff Report AGES-820506, 1982.

Haavelmo, Trygve. "The Probability Approach to Econometrics," *Econometrica*, Supplement:1-144, 1944.

Hildebrand, F.B. *Introduction to Numerical Analysis*. Dover Publications, Inc., New York, second edition, 1974.

Manchester, Alden C. *The Public Role in the Dairy Economy: Why and How Governments Intervene in the Milk Business*. Westview Press, Boulder, CO, 1983.

Manchester, Alden C., and Don P. Blayney. *Milk Pricing in the United States*. U.S. Department of Agriculture, Economic Research Service, AIB-761, 2001.

Pratt, James E., Phillip M. Bishop, Eric M. Erba, Andrew M. Novakovic, and Mark W. Stephenson. *Normative Estimates of Class I Prices Across U.S. Milk Markets*. Cornell Program on Dairy Markets and Policy, R.B. 98-05, 1998.

Price, J. Michael, Richard P. Stillman, and Ralph Seeley. "The Food and Agricultural Policy Simulator: Implementation of the Milk Income Loss Contract Program." U.S. Department of Agriculture, Economic Research Service, 2003.

Salathe, Larry E., J. Michael Price, and Kenneth E. Gadson. "The Food and Agricultural Policy Simulator," *Agricultural Economics Research* 34(2):1-15, 1982.

United States Department of Agriculture, Agricultural Marketing Service. *Milk Marketing Order Statistics: Federal Milk Order Price Information, Price Formulas - 2002*. www.ams.usda.gov/dyfmos/mib/price_form_2002.htm. 2002a.

United States Department of Agriculture, Economic Research Service. *An Analysis of the Economic Effects of U.S. Dairy Policy and An Analysis of an Alternative Milk Pricing Approach*, Report Prepared for the Senate Committee on Agriculture, Nutrition and Forestry and the House Committee on Agriculture.

United States Department of Agriculture, Economic Research Service. *Dairy: Background for the 1985 Farm Legislation*. AIB-474, 1984.

United States Department of Agriculture, Farm Service Agency. *Fact Sheet: Milk Income Loss Contract Program*. November 2002b.

United States Department of Agriculture, Foreign Agricultural Service. *Fact Sheet: Dairy Export Incentive Program*. www.usda.bov/info/factsheets/deip/html. 2003a.

United States Department of Agriculture, Office of the Chief Economist. *USDA Agricultural Baseline Projections to 2012*. WAOB 2003-1, 2003b.

Appendix A: Impacts of Eliminating National Dairy Programs

Table 1—Wholesale price, nonfat dry milk

Item	Calendar year						Average
	2002	2003	2004	2005	2006	2007	
	Cents per pound						
Scenario 1	88.4	82.7	100.2	97.0	96.6	95.6	
Baseline	103.9	102.6	103.5	103.9	103.9	103.8	
Difference	-15.6	-19.9	-3.3	-6.9	-7.3	-8.1	-10.2
Percentage difference	-15.0	-19.4	-3.2	-6.6	-7.0	-7.8	-9.8
Scenario 2	76.9	78.6	95.6	92.3	92.1	91.1	
Baseline	103.9	102.6	103.5	103.9	103.9	103.8	
Difference	-27.0	-24.0	-7.9	-11.6	-11.8	-12.7	-15.8
Percentage difference	-26.0	-23.4	-7.6	-11.1	-11.3	-12.2	-15.3
Scenario 3	78.9	82.5	98.6	94.1	92.9	91.5	
Baseline	103.9	102.6	103.5	103.9	103.9	103.8	
Difference	-25.0	-20.1	-4.9	-9.7	-11.0	-12.3	-13.8
Percentage difference	-24.1	-19.6	-4.7	-9.4	-10.6	-11.8	-13.4
Scenario 4	82.9	87.1	102.8	98.0	96.6	95.0	
Baseline	103.9	102.6	103.5	103.9	103.9	103.8	
Difference	-21.0	-15.5	-0.7	-5.8	-7.3	-8.8	-9.8
Percentage difference	-20.2	-15.1	-0.6	-5.6	-7.1	-8.4	-9.5

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 2—Wholesale price, butter

Item	Calendar year						Average
	2002	2003	2004	2005	2006	2007	
	Cents per pound						
Scenario 1	99.1	90.9	104.7	111.5	117.9	126.3	
Baseline	88.5	73.3	91.6	100.1	106.6	113.8	
Difference	10.7	17.6	13.1	11.3	11.3	12.4	12.7
Percentage difference	12.1	24.0	14.2	11.3	10.6	10.9	13.9
Scenario 2	107.0	97.9	111.7	118.5	125.0	133.6	
Baseline	88.5	73.3	91.6	100.1	106.6	113.8	
Difference	18.6	24.6	20.1	18.3	18.4	19.7	19.9
Percentage difference	21.0	33.6	21.9	18.3	17.3	17.3	21.6
Scenario 3	107.4	98.9	113.0	119.6	125.8	134.2	
Baseline	88.5	73.3	91.6	100.1	106.6	113.8	
Difference	19.0	25.6	21.3	19.5	19.3	20.4	20.8
Percentage difference	21.4	35.0	23.2	19.5	18.1	17.9	22.5
Scenario 4	110.1	103.0	117.7	124.9	131.3	139.9	
Baseline	88.5	73.3	91.6	100.1	106.6	113.8	
Difference	21.6	29.7	26.1	24.7	24.8	26.0	25.5
Percentage difference	24.5	40.6	28.5	24.7	23.2	22.9	27.4

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 3—Wholesale price, American cheese

Item	Calendar year						Average
	2002	2003	2004	2005	2006	2007	
	Cents per pound						
Scenario 1	113.6	107.2	131.4	131.7	133.9	136.7	
Baseline	120.4	116.7	128.8	132.5	135.0	138.0	
Difference	-6.8	-9.6	2.6	-0.8	-1.1	-1.3	-2.8
Percentage difference	-5.6	-8.2	2.0	-0.6	-0.8	-1.0	-2.4
Scenario 2	108.7	106.1	130.6	130.9	133.2	136.0	
Baseline	120.4	116.7	128.8	132.5	135.0	138.0	
Difference	-11.7	-10.7	1.8	-1.6	-1.8	-1.9	-4.3
Percentage difference	-9.7	-9.1	1.4	-1.2	-1.3	-1.4	-3.6
Scenario 3	110.2	109.3	133.6	133.0	134.3	136.7	
Baseline	120.4	116.7	128.8	132.5	135.0	138.0	
Difference	-10.3	-7.4	4.8	0.5	-0.6	-1.2	-2.4
Percentage difference	-8.5	-6.4	3.7	0.4	-0.5	-0.9	-2.0
Scenario 4	113.8	114.5	139.0	138.3	139.6	141.9	
Baseline	120.4	116.7	128.8	132.5	135.0	138.0	
Difference	-6.6	-2.3	10.2	5.9	4.7	4.0	2.6
Percentage difference	-5.5	-1.9	7.9	4.4	3.5	2.9	1.9

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 4—Effective Class I price of milk

Item	Calendar year						Average
	2002	2003	2004	2005	2006	2007	
	Dollars per hundredweight						
Scenario 1	13.97	13.09	15.26	15.29	15.55	15.85	
Baseline	14.83	14.01	14.94	15.36	15.67	15.99	
Difference	-0.86	-0.92	0.32	-0.08	-0.11	-0.13	-0.3
Percentage difference	-5.8	-6.6	2.1	-0.5	-0.7	-0.8	-2.0
Scenario 2	13.34	13.06	15.18	15.21	15.49	15.80	
Baseline	14.83	14.01	14.94	15.36	15.67	15.99	
Difference	-1.49	-0.95	0.24	-0.16	-0.17	-0.19	-0.45
Percentage difference	-10.0	-6.8	1.6	-1.0	-1.1	-1.2	-3.1
Scenario 3	13.53	13.45	15.50	15.42	15.60	15.86	
Baseline	14.83	14.01	14.94	15.36	15.67	15.99	
Difference	-1.30	-0.57	0.56	0.06	-0.07	-0.12	-0.24
Percentage difference	-8.8	-4.0	3.8	0.4	-0.4	-0.8	-1.6
Scenario 4	12.49	12.53	14.57	14.48	14.66	14.92	
Baseline	14.83	14.01	14.94	15.36	15.67	15.99	
Difference	-2.34	-1.49	-0.36	-0.88	-1.01	-1.07	-1.19
Percentage difference	-15.8	-10.6	-2.4	-5.7	-6.4	-6.7	-7.9

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 5—Producer price of manufacturing milk

Item	Calendar year						Average
	2002	2003	2004	2005	2006	2007	
	Dollars per hundredweight						
Scenario 1	10.31	9.64	11.70	11.73	11.95	12.21	
Baseline	10.96	10.45	11.43	11.78	12.03	12.32	
Difference	-0.66	-0.81	0.27	-0.05	-0.09	-0.10	-0.24
Percentage difference	-6.0	-7.8	2.3	-0.5	-0.7	-0.8	-2.2
Scenario 2	9.83	9.58	11.63	11.67	11.90	12.17	
Baseline	10.96	10.45	11.43	11.78	12.03	12.32	
Difference	-1.14	-0.87	0.21	-0.12	-0.13	-0.15	-0.37
Percentage difference	-10.4	-8.3	1.8	-1.0	-1.1	-1.2	-3.4
Scenario 3	9.97	9.89	11.91	11.86	12.00	12.23	
Baseline	10.96	10.45	11.43	11.78	12.03	12.32	
Difference	-0.99	-0.56	0.48	0.07	-0.04	-0.09	-0.19
Percentage difference	-9.0	-5.4	4.2	0.6	-0.3	-0.7	-1.8
Scenario 4	10.34	10.38	12.41	12.35	12.49	12.72	
Baseline	10.96	10.45	11.43	11.78	12.03	12.32	
Difference	-0.62	-0.07	0.98	0.57	0.46	0.40	0.29
Percentage difference	-5.7	-0.6	8.6	4.8	3.8	3.2	2.4

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 6—Producer price of all milk

Item	Calendar year						Average
	2002	2003	2004	2005	2006	2007	
	Dollars per hundredweight						
Scenario 1	11.76	11.02	13.09	13.10	13.32	13.57	
Baseline	12.47	11.84	12.79	13.15	13.40	13.67	
Difference	-0.71	-0.82	0.30	-0.05	-0.08	-0.10	-0.24
Percentage difference	-5.7	-7.0	2.4	-0.4	-0.6	-0.7	-2.0
Scenario 2	11.24	10.98	13.03	13.04	13.27	13.53	
Baseline	12.47	11.84	12.79	13.15	13.40	13.67	
Difference	-1.23	-0.86	0.24	-0.11	-0.13	-0.14	-0.37
Percentage difference	-9.9	-7.3	1.9	-0.8	-0.9	-1.0	-3.0
Scenario 3	11.40	11.31	13.32	13.24	13.37	13.59	
Baseline	12.47	11.84	12.79	13.15	13.40	13.67	
Difference	-1.07	-0.53	0.53	0.09	-0.03	-0.08	-0.18
Percentage difference	-8.6	-4.5	4.2	0.7	-0.2	-0.6	-1.5
Scenario 4	11.30	11.34	13.36	13.28	13.42	13.64	
Baseline	12.47	11.84	12.79	13.15	13.40	13.67	
Difference	-1.17	-0.50	0.57	0.13	0.02	-0.03	-0.16
Percentage difference	-9.4	-4.2	4.5	1.0	0.2	-0.2	-1.4

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 7—Milk used for butter production

| Item | Calendar year | | | | | | Average |
	2002	2003	2004	2005	2006	2007	
	Billion pounds (milk equivalent)						
Scenario 1	25.4	26.2	26.6	27.2	27.8	28.4	
Baseline	26.9	28.6	28.5	28.7	29.3	30.0	
Difference	-1.5	-2.3	-1.9	-1.5	-1.5	-1.6	-1.7
Percentage difference	-5.5	-8.2	-6.5	-5.3	-5.1	-5.3	-6.0
Scenario 2	24.4	25.3	25.7	26.3	26.9	27.5	
Baseline	26.9	28.6	28.5	28.7	29.3	30.0	
Difference	-2.6	-3.3	-2.8	-2.5	-2.4	-2.5	-2.7
Percentage difference	-9.6	-11.6	-9.9	-8.6	-8.3	-8.4	-9.4
Scenario 3	24.3	25.1	25.4	26.1	26.7	27.4	
Baseline	26.9	28.6	28.5	28.7	29.3	30.0	
Difference	-2.7	-3.5	-3.0	-2.7	-2.6	-2.6	-2.8
Percentage difference	-9.9	-12.3	-10.6	-9.2	-8.8	-8.8	-9.9
Scenario 4	23.9	24.5	24.8	25.4	26.1	26.7	
Baseline	26.9	28.6	28.5	28.7	29.3	30.0	
Difference	-3.0	-4.0	-3.6	-3.3	-3.2	-3.3	-3.4
Percentage difference	-11.1	-14.1	-12.8	-11.5	-11.1	-11.0	-11.9

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 8—Milk used for cheese production

| Item | Calendar year | | | | | | Average |
	2002	2003	2004	2005	2006	2007	
	Billion pounds (milk equivalent)						
Scenario 1	61.6	61.8	63.4	65.0	66.5	68.1	
Baseline	61.2	61.7	63.4	65.0	66.5	68.0	
Difference	0.4	0.1	0.0	0.0	0.1	0.1	0.1
Percentage difference	0.7	0.2	0.1	0.1	0.1	0.1	0.2
Scenario 2	61.9	61.8	63.4	65.1	66.6	68.1	
Baseline	61.2	61.7	63.4	65.0	66.5	68.0	
Difference	0.7	0.2	0.1	0.1	0.1	0.1	0.2
Percentage difference	1.2	0.3	0.1	0.1	0.1	0.1	0.3
Scenario 3	61.8	61.7	63.3	64.9	66.5	68.1	
Baseline	61.2	61.7	63.4	65.0	66.5	68.0	
Difference	0.6	0.0	-0.1	0.0	0.0	0.1	0.1
Percentage difference	1.0	0.0	-0.1	0.0	0.1	0.1	0.2
Scenario 4	61.5	61.4	63.0	64.6	66.2	67.8	
Baseline	61.2	61.7	63.4	65.0	66.5	68.0	
Difference	0.4	-0.3	-0.4	-0.3	-0.2	-0.2	-0.2
Percentage difference	0.6	-0.5	-0.6	-0.5	-0.4	-0.3	-0.3

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 9—Milk, fluid use

Item	Calendar year						Average
	2002	2003	2004	2005	2006	2007	
	Billion pounds (milk equivalent)						
Scenario 1	55.1	55.5	54.8	54.3	53.8	53.2	
Baseline	54.8	54.9	54.5	54.0	53.5	53.0	
Difference	0.3	0.6	0.3	0.3	0.2	0.2	0.3
Percentage difference	0.6	1.1	0.6	0.5	0.4	0.4	0.6
Scenario 2	55.4	55.7	55.0	54.5	53.9	53.3	
Baseline	54.8	54.9	54.5	54.0	53.5	53.0	
Difference	0.6	0.8	0.5	0.4	0.4	0.3	0.5
Percentage difference	1.1	1.5	0.9	0.8	0.7	0.6	0.9
Scenario 3	55.3	55.5	54.7	54.2	53.7	53.1	
Baseline	54.8	54.9	54.5	54.0	53.5	53.0	
Difference	0.5	0.6	0.2	0.1	0.1	0.1	0.3
Percentage difference	1.0	1.1	0.4	0.3	0.2	0.3	0.5
Scenario 4	55.7	56.2	55.6	55.2	54.7	54.2	
Baseline	54.8	54.9	54.5	54.0	53.5	53.0	
Difference	1.0	1.3	1.1	1.1	1.2	1.3	1.2
Percentage difference	1.7	2.4	2.0	2.1	2.2	2.4	2.1

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 10—Milk production

Item	Calendar year						Average
	2002	2003	2004	2005	2006	2007	
	Billion pounds (milk equivalent)						
Scenario 1	168.4	170.1	171.7	173.6	175.4	177.2	
Baseline	169.2	171.8	173.2	174.9	176.7	178.6	
Difference	-0.8	-1.7	-1.6	-1.3	-1.3	-1.4	-1.3
Percentage difference	-0.5	-1.0	-0.9	-0.7	-0.7	-0.8	-0.8
Scenario 2	167.9	169.3	170.9	172.8	174.6	176.4	
Baseline	169.2	171.8	173.2	174.9	176.7	178.6	
Difference	-1.3	-2.4	-2.3	-2.1	-2.1	-2.2	-2.1
Percentage difference	-0.8	-1.4	-1.4	-1.2	-1.2	-1.2	-1.2
Scenario 3	167.6	168.7	170.2	172.2	174.1	176.0	
Baseline	169.2	171.8	173.2	174.9	176.7	178.6	
Difference	-1.6	-3.1	-3.0	-2.7	-2.5	-2.6	-2.6
Percentage difference	-0.9	-1.8	-1.8	-1.5	-1.4	-1.4	-1.5
Scenario 4	167.5	168.6	170.1	172.2	174.2	176.2	
Baseline	169.2	171.8	173.2	174.9	176.7	178.6	
Difference	-1.7	-3.2	-3.1	-2.7	-2.4	-2.4	-2.6
Percentage difference	-1.0	-1.9	-1.8	-1.5	-1.4	-1.3	-1.5

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 11—Cash receipts from marketings of dairy products

Item	2002	2003	2004	2005	2006	2007	Cumulative sum
			Billion dollars				
Scenario 1	17.8	17.3	21.5	21.8	22.4	23.1	
Baseline	19.1	18.9	21.2	22.0	22.7	23.5	
Difference	-1.3	-1.6	0.3	-0.2	-0.3	-0.4	-3.5
Scenario 2	16.9	17.1	21.3	21.6	22.2	22.9	
Baseline	19.1	18.9	21.2	22.0	22.7	23.5	
Difference	-2.2	-1.7	0.1	-0.5	-0.5	-0.5	-5.3
Scenario 3	17.1	17.6	21.7	21.8	22.3	23.0	
Baseline	19.1	18.9	21.2	22.0	22.7	23.5	
Difference	-2.0	-1.2	0.5	-0.2	-0.4	-0.5	-3.8
Scenario 4	17.0	17.7	21.8	21.9	22.4	23.1	
Baseline	19.1	18.9	21.2	22.0	22.7	23.5	
Difference	-2.1	-1.2	0.6	-0.1	-0.3	-0.4	-3.6

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 12—MILC payments

Item	2002	2003	2004	2005	2006	2007	Cumulative sum
			Billion dollars				
Scenario 1	1.2	1.5	0.8	0.6	0.0	0.0	
Baseline	0.9	1.2	0.9	0.6	0.0	0.0	
Difference	0.3	0.3	-0.1	0.0	0.0	0.0	0.6
Scenario 2	1.5	1.6	0.8	0.6	0.0	0.0	
Baseline	0.9	1.2	0.9	0.6	0.0	0.0	
Difference	0.5	0.4	-0.1	0.0	0.0	0.0	0.9
Scenario 3	0.0	0.0	0.0	0.0	0.0	0.0	
Baseline	0.9	1.2	0.9	0.6	0.0	0.0	
Difference	-0.9	-1.2	-0.9	-0.6	0.0	0.0	-3.6
Scenario 4	0.0	0.0	0.0	0.0	0.0	0.0	
Baseline	0.9	1.2	0.9	0.6	0.0	0.0	
Difference	-0.9	-1.2	-0.9	-0.6	0.0	0.0	-3.6

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 13—CCC dairy net expenditures

Item	Fiscal year						Cumulative sum
	2002	2003	2004	2005	2006	2007	
	Million dollars						
Scenario 1	65.6	2,565.9	971.1	758.5	88.8	56.0	
Baseline	240.0	2,353.6	1,284.6	1,021.0	342.8	320.6	
Difference	-174.4	212.3	-313.5	-262.5	-254.0	-264.6	-1,056.8
Scenario 2	50.2	2,776.5	935.4	723.5	30.9	-2.8	
Baseline	240.0	2,353.6	1,284.6	1,021.0	342.8	320.6	
Difference	-189.8	422.8	-349.2	-297.4	-311.9	-323.5	-1,049.0
Scenario 3	50.2	-2.8	-2.8	-2.8	-2.8	-2.8	
Baseline	240.0	2,353.6	1,284.6	1,021.0	342.8	320.6	
Difference	-189.8	-2,356.5	-1,287.4	-1,023.8	-345.6	-323.5	-5,526.6
Scenario 4	50.2	-2.8	-2.8	-2.8	-2.8	-2.8	
Baseline	240.0	2,353.6	1,284.6	1,021.0	342.8	320.6	
Difference	-189.8	-2,356.5	-1,287.4	-1,023.8	-345.6	-323.5	-5,526.6

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 14—Gross receipts by dairy producers

Item	Calendar year						Cumulative sum
	2002	2003	2004	2005	2006	2007	
	Billion dollars						
Scenario 1	19.1	18.8	22.3	22.4	22.4	23.1	
Baseline	20.0	20.1	22.1	22.6	22.7	23.5	
Difference	-1.0	-1.2	0.2	-0.2	-0.3	-0.4	-2.9
Scenario 2	18.4	18.7	22.1	22.2	22.2	22.9	
Baseline	20.0	20.1	22.1	22.6	22.7	23.5	
Difference	-1.7	-1.4	0.0	-0.4	-0.5	-0.5	-4.5
Scenario 3	17.1	17.6	21.7	21.8	22.3	23.0	
Baseline	20.0	20.1	22.1	22.6	22.7	23.5	
Difference	-2.9	-2.5	-0.4	-0.8	-0.4	-0.5	-7.4
Scenario 4	17.0	17.7	21.8	21.9	22.4	23.1	
Baseline	20.0	20.1	22.1	22.6	22.7	23.5	
Difference	-3.1	-2.4	-0.3	-0.7	-0.3	-0.4	-7.2

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Table 15—Net farm income for the agricultural sector

Item	Calendar year						Cumulative sum
	2002	2003	2004	2005	2006	2007	
	Billion dollars						
Scenario 1	36.0	51.0	54.0	51.6	50.8	48.1	
Baseline	37.0	51.9	53.4	51.6	50.8	48.1	
Difference	-0.9	-0.9	0.6	-0.1	0.0	-0.1	-1.4
Scenario 2	35.3	51.1	53.9	51.5	50.8	48.1	
Baseline	37.0	51.9	53.4	51.6	50.8	48.1	
Difference	-1.6	-0.8	0.5	-0.1	0.0	0.0	-2.1
Scenario 3	34.3	50.3	53.6	51.3	51.1	48.2	
Baseline	37.0	51.9	53.4	51.6	50.8	48.1	
Difference	-2.7	-1.6	0.3	-0.3	0.2	0.1	-4.0
Scenario 4	34.1	50.3	53.7	51.4	51.2	48.3	
Baseline	37.0	51.9	53.4	51.6	50.8	48.1	
Difference	-2.8	-1.6	0.3	-0.2	0.3	0.2	-3.8

Note: Scenario 1 = Elimination of the MPSP; Scenario 2 = Elimination of the MPSP and DEIP; Scenario 3 = Elimination of the MPSP, DEIP, and MILC; Scenario 4 = Elimination of the MPSP, DEIP, MILC, and FMMO system.

Appendix B—Food and Agricultural Policy Simulator: Model Overview

The Food and Agricultural Policy Simulator (FAPSIM) is an annual, dynamic econometric model of the U.S. agricultural sector. The model was originally developed at the U.S. Department of Agriculture during the early 1980s (Salathe, Price, and Gadson, 1982; Gadson, Price, and Salathe, 1982). Since that time, FAPSIM has been continually reestimated and respecified to reflect changes in the structure of the U.S. food and agricultural sector.

Model Structure

The model contains four broad types of relationships: definitional, institutional, behavioral, and temporal.[1] Definitional equations include identities that reflect mathematical relationships that must hold among the data in the model. For example, total demand must equal total supply for a commodity at any point in time. The model constrains solutions to satisfy all identities of this type.

Institutional equations involve relationships between variables that reflect certain institutional arrangements in the sector. As an example, the 2002 Act established countercyclical payments for producers of certain crops and the Milk Income Loss Contract Program for dairy producers. Both programs are designed to provide government payments to producers in order to augment their income when commodity prices are low. The payment rates for both of these programs are determined by institutional equations in FAPSIM that reflect the payment formulas established by the legislation.

The two preceding types of equations reflect known relationships that necessarily hold among the variables in the model. Behavioral equations are quite different because the exact relationship is not known and must be estimated. Economic theory is used to determine the types of variables to include in behavioral equations, but theory does not indicate precisely how the variables should be related to each other. Examples of behavioral relationships in FAPSIM are the acreage equations for different field crops. Economic theory indicates that production should be positively related

to the price received for the commodity and negatively related to prices of inputs required in the production process. Producer net returns are used in the FAPSIM acreage equations to capture these economic effects. The net returns measures also include policy features, such as marketing loan provisions, that can influence planting choices. Additionally, net returns for other crops that compete with each other for land use are included in the acreage equations.

For the most part, a linear relationship is used to approximate the general functional form for each behavioral relationship. Generally, the parameters in the linear behavioral relationships were estimated by single equation regression methods. The large size of the model precludes the use of econometric methods designed for systems of equations. Ordinary least squares was used to estimate the majority of the equations. If statistical tests indicated the presence of either autocorrelation or heteroscedasticity in the error structure of an equation, maximum likelihood methods or weighted least squares were used.

Temporal relationships are empirical equations that describe the interrelationships between variables measured using different units of time. For example, not all the variables in FAPSIM are measured using the same concept of a year. Commodity data are reported on a marketing year basis; budgetary data are reported on a fiscal year basis; and farm income data are reported on a calendar year basis. As a result, empirical equations are sometimes needed to establish relationships among variables in these different categories. For example, cash receipts from soybeans are reported on a calendar year basis. FAPSIM estimates farm prices and production of soybeans on a marketing year basis. If cash receipts were reported on a marketing year basis, the product of farm price and production could be used to estimate receipts. Because cash receipts are reported on a calendar year basis, an empirical equation is used to estimate cash receipts using information from both marketing years that overlap the calendar year.

Model Content

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[1] The first three types of relationship are essentially those described by Haavelmo (1944, p. 203).

The commodities included in FAPSIM are corn, sorghum, barley, oats, wheat, rice, soybeans, soybean meal, soybean oil, upland cotton, cattle, hogs, broilers, turkeys, eggs, and dairy. The dairy model contains submodels for fluid milk, evaporated and condensed milk, frozen dairy products, cheese, butter, and nonfat dry milk. Each commodity submodel contains equations to estimate production, prices, and the different demand components. FAPSIM also includes submodels to estimate the value of exports, net farm income, government outlays on farm programs, retail food prices, and consumer expenditures on food. All of the submodels are linked together through the variables that they share in common with one another.

The solution algorithm used for the model is based on the Gauss-Seidel procedure (Hildebrand, 1974). FAP-SIM computes the set of market prices that equilibrate supply and demand in all of the commodity markets simultaneously, given any set of exogenous conditions.